

Global Burden of Non-Communicable Diseases: The Expanding Role of Internal Medicine in Low- and Middle-Income Countries

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Abstract

Non-communicable diseases (NCDs) have emerged as the leading cause of global morbidity and mortality, accounting for a substantial proportion of premature deaths worldwide. Low- and middle-income countries (LMICs) now bear the greatest burden of cardiovascular diseases, diabetes mellitus, chronic respiratory diseases, and cancers, driven by rapid urbanization, population aging, unhealthy lifestyles, and persistent socioeconomic inequalities. The growing prevalence of NCDs in these regions has placed enormous pressure on already fragile healthcare systems that continue to struggle with limited resources, inadequate infrastructure, shortages of trained healthcare professionals, and the persistent burden of infectious diseases. This review explores the evolving epidemiology of NCDs in LMICs and examines the major behavioral, metabolic, and environmental factors contributing to their increasing incidence. It further highlights the critical challenges associated with prevention, diagnosis, treatment, and long-term disease management in resource-constrained settings. Particular emphasis is placed on the expanding role of internal medicine in addressing the complex and chronic nature of NCDs through early diagnosis, comprehensive patient-centered care, multimorbidity management, preventive interventions, and coordinated healthcare delivery. In addition, the review discusses emerging strategies including digital health technologies, telemedicine, multidisciplinary care models, and health policy reforms aimed at strengthening NCD control in LMICs. By emphasizing the central role of internal medicine in improving healthcare outcomes, this review provides valuable insight into sustainable approaches for reducing the global burden of NCDs and advancing equitable healthcare delivery in developing regions.

Keywords: Non-communicable diseases, Internal medicine, Low- and middle-income countries, Chronic disease

Introduction

Non-communicable diseases (NCDs) have become the dominant cause of global mortality and disability, replacing many infectious diseases as the primary drivers of premature death and long-term health complications. Cardiovascular diseases, diabetes mellitus, cancers, and chronic respiratory diseases account for the largest proportion of NCD-related deaths worldwide, particularly in low- and middle-income countries (LMICs) where

healthcare systems remain inadequately equipped to manage chronic illnesses (Mohan *et al.*, 2023; GBD 2021). Rapid urbanization, unhealthy diets, physical inactivity, tobacco use, alcohol consumption, and environmental pollution

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have significantly accelerated the prevalence of these diseases across developing regions (Ebele, 2021; Barry *et al.*, 2025). Consequently, NCDs now represent a major threat to economic productivity, healthcare sustainability, and global public health outcomes.

The burden of NCDs in LMICs is further complicated by persistent healthcare inequalities, weak infrastructure, and the continuing presence of communicable diseases. Many countries in Africa, Asia, and Latin America are currently experiencing an epidemiological transition characterized by the coexistence of infectious diseases and rapidly increasing chronic illnesses (WHO, 2025). This double burden places substantial pressure on healthcare systems already constrained by shortages of trained professionals, inadequate diagnostic facilities, and limited access to essential medicines (Allen *et al.*, 2020; Barry *et al.*, 2025). In addition, poverty, low health literacy, and insufficient preventive healthcare services continue to contribute to delayed diagnosis and poor disease outcomes among vulnerable populations (Ebele, 2021; Akselrod *et al.*, 2024).

Internal medicine has increasingly assumed a central role in addressing the growing burden of NCDs due to its comprehensive and patient-centered approach to chronic disease management. Internists are essential in early diagnosis, risk assessment, preventive medicine, and long-term management of patients with multiple comorbidities and complex clinical conditions (Misra *et al.*, 2023; Mohan *et al.*, 2023). In many LMICs, internal medicine specialists serve as critical links between primary healthcare services and tertiary medical care, helping to coordinate multidisciplinary treatment strategies and continuity of care (Akselrod *et al.*, 2024). Their role has become particularly important as chronic diseases increasingly require integrated healthcare models focused on prevention, long-term monitoring, and individualized treatment approaches (DiPette *et al.*, 2019; Misra *et al.*, 2023).

Recent advancements in healthcare delivery and policy development have created new opportunities for improving NCD prevention and management globally (Akselrod *et al.*, 2024). Digital health technologies, telemedicine, and artificial intelligence are increasingly being integrated into healthcare systems to improve disease surveillance, treatment adherence, patient monitoring, and healthcare accessibility in resource-limited settings (WHO, 2024). Furthermore, global initiatives promoting universal health coverage and multisectoral approaches to disease prevention have strengthened international commitment toward reducing the burden of NCDs (Allen *et al.*, 2020). Despite these developments, major disparities remain in

healthcare financing, workforce capacity, technological infrastructure, and equitable access to quality healthcare services, particularly across LMICs (Barry *et al.*, 2025; WHO, 2025).

This review examines the growing global burden of non-communicable diseases and the expanding role of internal medicine in addressing these challenges within low- and middle-income countries. The review focuses on the major categories of NCDs, including cardiovascular diseases, diabetes mellitus, cancers, and chronic respiratory diseases, which collectively contribute significantly to global morbidity, mortality, and healthcare expenditure. It explores the epidemiological trends and major behavioral, metabolic, environmental, and socioeconomic risk factors responsible for the rising prevalence of chronic diseases in developing regions. The review also evaluates the major barriers affecting effective prevention, diagnosis, treatment, and long-term management of NCDs in LMICs. These challenges include weak healthcare systems, inadequate healthcare financing, shortages of trained healthcare professionals, poor access to diagnostic tools and essential medicines, and unequal healthcare distribution. Special attention is given to the increasing responsibilities of internal medicine in chronic disease prevention, integrated patient-centered care, multimorbidity management, and continuity of healthcare delivery. Furthermore, the review discusses emerging strategies aimed at improving NCD outcomes through digital health innovations, telemedicine, multidisciplinary care approaches, preventive interventions, and policy reforms designed to strengthen healthcare systems. By synthesizing current evidence and global perspectives, this review aims to provide a concise understanding of the evolving burden of NCDs and the critical contribution of internal medicine toward achieving sustainable, equitable, and effective healthcare delivery in resource-constrained settings.

Epidemiology and Major Drivers of NCDs

Common NCDs in LMICs

Non-communicable diseases (NCDs) have become the dominant contributors to morbidity and mortality in low- and middle-income countries (LMICs), where rapid demographic transition, urbanization, and lifestyle changes continue to accelerate disease prevalence. Cardiovascular diseases remain the leading NCDs globally, accounting for a substantial proportion of deaths and long-term disabilities in developing regions (Mensah *et al.*, 2015; Roth *et al.*, 2020; Vaduganathan *et al.*, 2022). Hypertension, ischemic heart disease, heart failure, and stroke are particularly prevalent due to increasing exposure to unhealthy diets,

physical inactivity, obesity, and tobacco use (Roth *et al.*, 2020; Vaduganathan *et al.*, 2022; GBD 2023 Risk Factors Collaborators, 2024). Diabetes mellitus has also emerged as a rapidly growing public health concern in LMICs because of sedentary lifestyles, nutritional transition, and increasing obesity rates associated with urban living (GBD 2017 Diet Collaborators, 2019; Khan *et al.*, 2020; Chan *et al.*, 2021). Chronic respiratory diseases, especially chronic obstructive pulmonary disease and asthma, continue to increase because of tobacco smoking, biomass fuel exposure, occupational hazards, and environmental pollution (Chattu and Pooransingh, 2020; Vieg *et al.*,

2020; Safiri *et al.*, 2022). In addition, cancers such as breast, lung, cervical, colorectal, and liver cancers are becoming increasingly prevalent in LMICs due to delayed diagnosis, poor screening programs, and limited oncology services (Bray *et al.*, 2024; Ferlay *et al.*, 2024; Burka *et al.*, 2025). The coexistence of multiple chronic diseases among individuals further complicates disease management and contributes significantly to healthcare burden in resource-limited settings (Hajat and Stein, 2018; Chan *et al.*, 2021; GBD 2023 Disease and Injury and Risk Factor Collaborators, 2025).

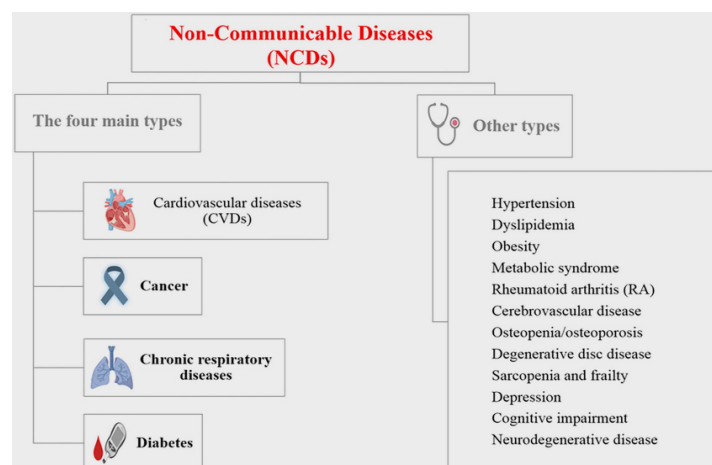


Fig1. List of non-communicable diseases (NCDs). This figure shows the major types of non-communicable diseases (NCDs) and others including cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes. These diseases are long-term and not caused by infections but mainly linked to lifestyle and genetic risk factors.

Source: Budrevičiūtė *et al.* (2020)

Mortality and Disability Burden

The mortality and disability burden associated with NCDs has increased substantially over recent decades and now represents one of the greatest global public health challenges. According to recent Global Burden of Disease findings, NCDs account for the majority of deaths and disability-adjusted life years (DALYs) worldwide, with LMICs contributing disproportionately to premature mortality rates (Roth *et al.*, 2020; Vaduganathan *et al.*, 2022; GBD 2023 Disease and Injury and Risk Factor Collaborators, 2025). Cardiovascular diseases remain the largest contributors to premature mortality, particularly in sub-Saharan Africa where healthcare systems often lack adequate preventive and therapeutic services (Mensah *et al.*, 2015; Chattu and Pooransingh, 2020; Roth *et al.*, 2020). Diabetes mellitus contributes significantly to chronic disability through complications such as nephropathy, neuropathy, retinopathy, and cardiovascular disease, all of which reduce quality of life and economic productivity

(Khan *et al.*, 2020; Chan *et al.*, 2021; GBD 2023 Risk Factors Collaborators, 2024). Similarly, chronic respiratory diseases and cancers are major causes of prolonged hospitalization, reduced workforce participation, and increased healthcare dependence in LMICs (Vieg *et al.*, 2020; Safiri *et al.*, 2022; Bray *et al.*, 2024). Inadequate healthcare financing, delayed diagnosis, limited access to treatment, and weak rehabilitation systems further worsen disease outcomes and health inequalities among vulnerable populations (Hajat and Stein, 2018; Chattu and Pooransingh, 2020; Burka *et al.*, 2025). Consequently, NCDs continue to exert substantial social and economic pressure on healthcare systems and national development across many developing countries (Chan *et al.*, 2021; Vaduganathan *et al.*, 2022; GBD 2023 Disease and Injury and Risk Factor Collaborators, 2025).

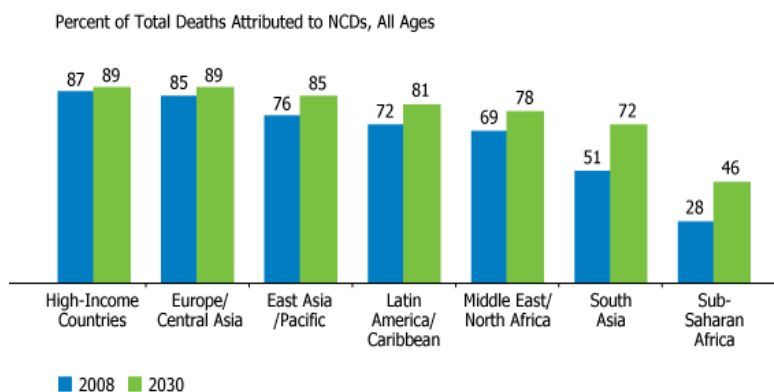


Fig2.Percentage of total deaths caused by non-communicable diseases (NCDs) in different regions for 2008 and 2030 projections. This figure compares the share of deaths caused by non-communicable diseases across different regions in 2008 and projected for 2030. It shows a general increase in NCD-related mortality over time in most regions. High-burden regions are expected to experience the greatest rise. This highlights the growing global health impact of NCDs.

Source: Irina *et al.* (2011)

Behavioral, Metabolic, and Socioeconomic Risk Factors

The increasing burden of NCDs in LMICs is strongly associated with behavioral, metabolic, environmental, and socioeconomic risk factors that have become increasingly prevalent due to modernization and urbanization. Tobacco smoking, harmful alcohol consumption, unhealthy diets, and physical inactivity are among the leading modifiable behavioral risk factors driving the global rise of chronic diseases (GBD 2017 Diet Collaborators, 2019; Chattu and Pooransingh, 2020; GBD 2023 Risk Factors Collaborators,

2024).

These unhealthy behaviors contribute significantly to metabolic abnormalities such as hypertension, obesity, hyperglycemia, and dyslipidemia, which substantially increase the risk of cardiovascular diseases, diabetes, cancers, and chronic respiratory disorders (Khan *et al.*, 2020; Chan *et al.*, 2021; Vaduganathan *et al.*, 2022). Rapid urbanization in LMICs has also promoted increased consumption of processed foods rich in salt, sugar, and saturated fats while reducing opportunities for physical activity (GBD 2017 Diet Collaborators, 2019; Roth *et al.*,

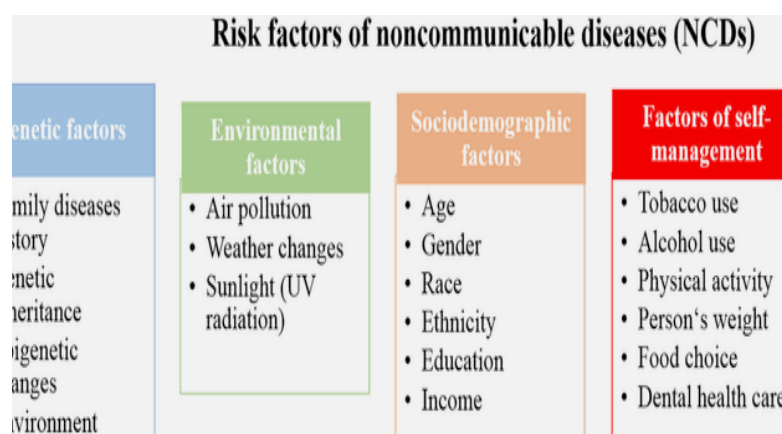


Fig3.The risk factors of NCDs. This figure shows the main risk factors responsible for non-communicable diseases including behavioural factors such as unhealthy diet, physical inactivity, tobacco use, and alcohol consumption and metabolic risks like obesity, high blood pressure, and high blood sugar are also important. These factors increase the likelihood of developing chronic diseases.

Source: Budrevičiūtė *et al.* (2020)

2020; Safiri *et al.*, 2022). Socioeconomic determinants including poverty, poor educational attainment, unemployment, weak healthcare access, and low health literacy further contribute to delayed diagnosis, inadequate treatment adherence, and increased disease complications among vulnerable populations (Hajat and Stein, 2018; Chattu and Pooransingh, 2020; Burka *et al.*, 2025). Environmental pollution, occupational exposure, and psychosocial stress also continue to worsen chronic disease outcomes, particularly among densely populated urban communities with limited public health interventions and weak healthcare systems (Viegi *et al.*, 2020; Ferlay *et al.*, 2024; GBD 2023 Risk Factors Collaborators, 2024).

Challenges of NCD Management in LMICs

The management of non-communicable diseases (NCDs) in low- and middle-income countries (LMICs) remains highly challenging because of fragile healthcare systems, inadequate financing, workforce limitations, and widening socioeconomic inequalities. Although the burden of chronic diseases continues to increase rapidly across developing regions, many LMICs still lack the institutional capacity and healthcare infrastructure required for effective prevention, early diagnosis, treatment, and long-term disease monitoring (Kruk *et al.*, 2018; Bukhman *et al.*, 2020). The coexistence of communicable and non-communicable diseases further intensifies pressure on already overstretched healthcare systems, particularly in resource-constrained settings where healthcare access and service quality remain limited (Assefa *et al.*, 2021; Phelan *et al.*, 2022). Consequently, addressing NCDs in LMICs requires comprehensive and sustainable healthcare reforms aimed at strengthening health systems, improving healthcare equity, and expanding access to essential services.

Weak Healthcare Systems

Weak healthcare systems remain a major obstacle to effective NCD prevention and management in LMICs. Many developing countries continue to experience inadequate healthcare infrastructure, fragmented referral systems, poor health information management, and insufficient institutional capacity for chronic disease care (Kruk *et al.*, 2018; Hanson *et al.*, 2022). Primary healthcare systems in several LMICs are traditionally structured to address acute infectious diseases rather than long-term chronic conditions requiring continuous monitoring and integrated multidisciplinary care (Bukhman *et al.*, 2020; Assefa *et al.*, 2021). Inadequate healthcare financing and weak implementation of evidence-based policies further limit the effectiveness of NCD prevention programs and continuity of patient care (Hanson *et al.*, 2022; El-Jardali

et al., 2023). Additionally, poor emergency preparedness, inadequate digital health integration, and limited healthcare governance continue to weaken healthcare delivery and reduce system resilience in many resource-limited settings (Assefa *et al.*, 2021; Phelan *et al.*, 2022). These systemic weaknesses significantly contribute to delayed diagnosis, poor disease control, and increased NCD-related morbidity and mortality.

Limited Access to Diagnostics and Treatment

Access to essential diagnostic services, medicines, and treatment interventions for NCDs remains inadequate across many LMICs. Large numbers of patients remain undiagnosed because of poor screening programs, inadequate laboratory infrastructure, and limited availability of diagnostic technologies in underserved communities (Atun *et al.*, 2017; Flood *et al.*, 2021). Even after diagnosis, long-term treatment is often hindered by high out-of-pocket healthcare costs, poor pharmaceutical supply systems, and inadequate health insurance coverage (Wirtz *et al.*, 2017; Hanson *et al.*, 2022). Essential medicines for hypertension, diabetes, chronic respiratory diseases, and cancers are frequently unavailable or unaffordable for many populations in low-resource settings (Wirtz *et al.*, 2017; Bukhman *et al.*, 2020). Limited access to specialized healthcare services such as oncology care, dialysis, cardiovascular interventions, and rehabilitation services also contributes significantly to poor clinical outcomes and increased mortality (Atun *et al.*, 2017; Phelan *et al.*, 2022). Furthermore, delayed diagnosis and interrupted treatment increase the risk of disease progression, complications, disability, and premature death among vulnerable populations (Flood *et al.*, 2021; Hanson *et al.*, 2022).

Workforce Shortages

Healthcare workforce shortages continue to undermine effective NCD management in many LMICs. Several developing countries experience critical shortages of physicians, nurses, pharmacists, laboratory scientists, and allied healthcare professionals needed for comprehensive chronic disease care (Kruk *et al.*, 2018; Boniol *et al.*, 2022). Unequal distribution of healthcare workers between urban and rural communities further limits healthcare accessibility for disadvantaged populations (Boniol *et al.*, 2022; Phelan *et al.*, 2022). In many settings, migration of trained healthcare professionals to high-income countries contributes to workforce instability and reduced healthcare capacity within already fragile systems (Assefa *et al.*, 2021; Boniol *et al.*, 2022). Inadequate training opportunities in chronic disease prevention, integrated healthcare delivery, and patient-centered care also reduce

the ability of healthcare providers to effectively manage complex NCD cases (Bukhman *et al.*, 2020; El-Jardali *et al.*, 2023). These workforce limitations negatively affect early diagnosis, patient counseling, treatment adherence, continuity of care, and long-term disease monitoring.

Economic and Healthcare Inequalities

Economic and healthcare inequalities significantly influence the burden and outcomes of NCDs in LMICs. Poverty is strongly associated with increased exposure to unhealthy diets, physical inactivity, inadequate housing, environmental hazards, and poor healthcare access (Niessen *et al.*, 2018; Rahman, 2022). Individuals from low-income households often face substantial barriers to preventive healthcare services, routine medical follow-up, and long-term medication adherence because of financial constraints and inadequate insurance coverage (Wirtz *et al.*, 2017; Rahman, 2022). Rural populations and marginalized communities also experience limited healthcare access due to poor transportation systems, inadequate healthcare facilities, and shortages of trained healthcare professionals (Hanson *et al.*, 2022; Phelan *et al.*, 2022). Low educational attainment and poor health literacy further contribute to delayed diagnosis and poor treatment outcomes among vulnerable groups (Niessen *et al.*, 2018; Rahman, 2022). Consequently, socioeconomic inequalities continue to widen disparities in chronic disease burden and healthcare outcomes across developing regions.

Double Burden of Communicable and Non-Communicable Diseases

Many LMICs currently face a double burden of communicable and non-communicable diseases, creating enormous challenges for healthcare systems with limited resources. Infectious diseases such as HIV/AIDS, tuberculosis, malaria, and neglected tropical diseases remain highly prevalent in many developing countries while NCDs continue to rise rapidly because of demographic transition and changing lifestyles (Bukhman *et al.*, 2020; Assefa *et al.*, 2021). This dual disease burden places significant pressure on healthcare financing, infrastructure, workforce capacity, and service delivery systems (Kruk *et al.*, 2018; Hanson *et al.*, 2022). Patients with communicable diseases are also increasingly developing chronic NCDs due to aging populations, long-term treatment effects, and shared behavioral risk factors (Atun *et al.*, 2017; Bukhman *et al.*, 2020). The coexistence of infectious diseases and chronic illnesses complicates patient management, increases healthcare expenditure, and worsens health outcomes among vulnerable populations (Niessen *et al.*, 2018; Phelan *et al.*, 2022). Addressing this double burden requires integrated healthcare systems capable of simultaneously managing acute infectious diseases and long-term chronic conditions through sustainable, patient-centered, and multidisciplinary approaches.

Table 1. Major challenges affecting non-communicable disease management in low- and middle-income countries

Challenge areas	Key Systemic Issue	Consequence in LMICs	Strategic priorities
Healthcare Infrastructure	Poorly coordinated chronic disease services and weak referral systems	Delayed continuity of care and poor patient outcomes	Strengthening primary healthcare systems
Diagnostic Capacity	Limited laboratory facilities and screening programs	Late diagnosis and increased disease complications	Expanding affordable diagnostic services
Medicine Availability	Irregular supply and high cost of essential medicines	Poor treatment adherence and uncontrolled disease progression	Improving medicine procurement and universal access
Health Financing	High out-of-pocket healthcare expenditure	Financial hardship and reduced healthcare utilization	Expanding universal health coverage
Human Resources for Health	Inadequate numbers and uneven distribution of healthcare professionals	Reduced quality and accessibility of NCD care	Workforce training and retention strategies
Rural–Urban Disparities	Unequal healthcare access between urban and rural populations	Worsening health inequalities	Equitable healthcare resource allocation
Health Literacy	Low public awareness of NCD prevention and management	Poor lifestyle practices and delayed healthcare seeking	Community health education and promotion
Policy Implementation	Weak enforcement of public health policies	Ineffective NCD prevention and control programs	Evidence-based policy strengthening

Dual Burden	Disease	Simultaneous prevalence of infectious diseases and NCDs	Overstretched healthcare systems and resource competition	Integrated disease management approaches
Socioeconomic Inequality		Poverty and limited social protection systems	Increased exposure to NCD risk factors	Multisectoral poverty-reduction interventions

Modified from Kruk *et al.* (2018); Bukhman *et al.* (2020); Hanson *et al.* (2022).

Expanding Role of Internal Medicine

The increasing burden of non-communicable diseases (NCDs) in low- and middle-income countries (LMICs) has considerably expanded the role of internal medicine in modern healthcare systems. Internal medicine physicians are central to the prevention, diagnosis, treatment, and long-term monitoring of chronic diseases because of their broad clinical expertise and ability to manage complex multisystem disorders (Beaglehole *et al.*, 2011; Haque *et al.*, 2020). As LMICs experience epidemiological transition and population ageing, healthcare systems increasingly rely on internists to provide coordinated and evidence-based management for chronic illnesses such as hypertension, diabetes, cardiovascular diseases, and chronic respiratory disorders (Mills *et al.*, 2020; NCD-RisC, 2021). The growing prevalence of multimorbidity and long-term complications further highlights the importance of internal medicine in improving healthcare quality, continuity of care, and patient outcomes in resource-constrained settings (Afshar *et al.*, 2015; Pearson-Stuttard *et al.*, 2019).

Early Diagnosis and Chronic Disease Management.

Early diagnosis remains one of the most important strategies for reducing morbidity and mortality associated with NCDs in LMICs. Internal medicine specialists contribute significantly through clinical assessment, risk-factor screening, disease monitoring, and evidence-based management of chronic conditions (Geldsetzer *et al.*, 2019; Mills *et al.*, 2020). Hypertension and diabetes frequently remain undiagnosed in many LMICs because of limited screening services and poor healthcare access, increasing the risk of preventable complications and premature mortality (NCD-RisC, 2021; Felix Ng'ambi *et al.*, 2026). Internists play a major role in initiating early treatment, monitoring disease progression, adjusting medications, and improving treatment adherence among patients with chronic diseases (Haque *et al.*, 2020; Beran *et al.*, 2021). Through continuity of care and individualized therapeutic approaches, internal medicine helps reduce hospitalization rates, improve disease control, and enhance quality of life among affected populations.

Management of Multimorbidity

The coexistence of multiple chronic conditions has become increasingly common in LMICs, particularly among ageing

populations. Patients frequently present with combinations of hypertension, diabetes, obesity, cardiovascular disease, and chronic kidney disease, requiring comprehensive and coordinated management strategies (Afshar *et al.*, 2015; Pearson-Stuttard *et al.*, 2019). Internal medicine physicians are uniquely trained to manage multimorbidity through holistic clinical evaluation, integrated treatment planning, and careful management of drug interactions and polypharmacy (Navickas *et al.*, 2016; Pearson-Stuttard *et al.*, 2019). Effective multimorbidity management also involves long-term monitoring, patient education, and coordinated multidisciplinary care aimed at reducing complications and improving functional outcomes (Afshar *et al.*, 2015; Navickas *et al.*, 2016). In many LMICs where specialist services remain limited, internists often function as primary coordinators of chronic disease care, thereby improving healthcare efficiency and continuity.

Preventive Care and Lifestyle Modification

Preventive care and lifestyle modification have become essential responsibilities within internal medicine practice because most NCDs are strongly associated with modifiable behavioral risk factors. Internal medicine physicians play critical roles in counseling patients on healthy diets, physical activity, smoking cessation, alcohol reduction, and weight management to reduce chronic disease risk (Beaglehole *et al.*, 2011; Haque *et al.*, 2020). Preventive interventions targeting hypertension, obesity, and metabolic abnormalities are particularly important for reducing cardiovascular disease burden in LMICs (Mills *et al.*, 2020; NCD-RisC, 2021). Internists also contribute to public health promotion through risk-factor screening, patient education, and preventive health assessments within both hospital and community settings (Geldsetzer *et al.*, 2019; Felix Ng'ambi *et al.*, 2026). By emphasizing prevention and behavioral modification, internal medicine supports long-term reductions in healthcare costs, disease complications, and premature mortality.

Integrated and Patient-Centered Care

Integrated and patient-centered care has become increasingly important for effective NCD management in LMICs. Internal medicine physicians contribute significantly to coordinated healthcare delivery by integrating preventive, diagnostic, therapeutic, and

rehabilitative services for patients with chronic illnesses (Navickas *et al.*, 2016; Haque *et al.*, 2020). Patient-centered care emphasizes individualized treatment planning, continuity of care, and shared decision-making while addressing the psychosocial and economic challenges associated with chronic diseases (Pearson-Stuttard *et al.*, 2019; Beran *et al.*, 2021). Internal medicine also promotes collaboration among multidisciplinary healthcare teams including nurses, pharmacists, physiotherapists, and dietitians to improve treatment outcomes and patient satisfaction (Afshar *et al.*, 2015; Haque *et al.*, 2020). These integrated approaches are essential for strengthening healthcare delivery systems and improving chronic disease management in resource-limited settings.

Community and Hospital-Based Interventions

Internal medicine increasingly supports both community-based and hospital-based interventions aimed at reducing

the burden of NCDs in LMICs. Within hospitals, internists manage acute complications, coordinate specialized care, and implement evidence-based treatment protocols for chronic diseases (Mills *et al.*, 2020; Beran *et al.*, 2021). Community-level interventions include health education campaigns, screening programs, outreach services, and follow-up care targeting high-risk populations (Haque *et al.*, 2020; Felix Ng'ambi *et al.*, 2026). Internal medicine also contributes to strengthening primary healthcare systems by supporting early disease detection and improving referral pathways between community and tertiary healthcare services (Beaglehole *et al.*, 2011; Geldsetzer *et al.*, 2019). These hospital-community strategies improve healthcare accessibility, enhance treatment continuity, and support sustainable management of chronic diseases across LMICs.

Role of Internal Medicine	Key activities	Expected Outcomes in LMICs
Early Diagnosis and Screening	Risk assessment, routine screening, clinical evaluation, and early detection of chronic diseases	Reduced late presentation, complications, and premature mortality
Chronic Disease Management	Long-term monitoring, medication optimization, and follow-up care	Improved disease control and quality of life
Multimorbidity Management	Coordinated care for patients with multiple chronic conditions	Reduced fragmented care and improved treatment efficiency
Preventive Care	Lifestyle counseling, behavioral modification, and risk-factor reduction	Lower incidence of preventable NCDs
Patient-Centered Care	Individualized treatment planning and shared decision-making	Improved patient adherence and satisfaction
Integrated Healthcare Delivery	Collaboration with multidisciplinary healthcare teams	Enhanced continuity and coordination of care
Community-Based Interventions	Outreach programs, health education, and population screening	Increased public awareness and early disease detection
Hospital-Based Interventions	Management of acute complications and specialist referrals	Reduced hospitalization complications and mortality
Access to Essential Medicines	Rational prescription and continuity of treatment	Better long-term management of chronic diseases

Adapted from Pearson-Stuttard *et al.* (2019); Haque *et al.* (2020)

Emerging Strategies and Future Directions

Addressing the growing burden of non-communicable diseases (NCDs) in low- and middle-income countries (LMICs) requires innovative and sustainable healthcare strategies focused on strengthening health systems, improving access to care, and expanding preventive services. Digital health and telemedicine are increasingly transforming chronic disease management by improving healthcare accessibility, continuity of care, and remote patient monitoring, particularly in underserved populations. Integration of digital technologies into

healthcare systems supports patient follow-up, treatment adherence, health education, and early disease detection while reducing geographical barriers to healthcare delivery (Labrique *et al.*, 2018). These approaches are especially valuable in LMICs where healthcare infrastructure and specialist availability remain limited.

Task-shifting and multidisciplinary healthcare models are also emerging as effective strategies for improving NCD management in resource-constrained settings. Delegating selected healthcare responsibilities to nurses, pharmacists, and community health workers can significantly improve

screening, monitoring, and long-term management of chronic diseases, particularly hypertension and diabetes (Joshi *et al.*, 2014; Anand *et al.*, 2019). Multidisciplinary care involving collaboration among internists, nurses, dietitians, and allied healthcare professionals further enhances continuity of care and reduces fragmentation in the management of multimorbidity, which is increasingly recognized as a major challenge for healthcare systems globally (Pearson-Stuttard *et al.*, 2019). These integrated models strengthen healthcare efficiency while improving patient outcomes and accessibility.

Future progress in NCD prevention and control also depends heavily on health policy reforms and expansion of universal health coverage (UHC). Strengthening primary healthcare systems, improving financial protection, and

increasing access to essential healthcare services remain critical priorities for LMICs (Haque *et al.*, 2020; WHO, 2025). Intersectoral policies targeting unhealthy diets, tobacco use, alcohol consumption, and physical inactivity are essential for reducing NCD risk factors and promoting long-term population health (Watkins *et al.*, 2017). Additionally, strengthening internal medicine capacity through workforce training, continuing professional development, and improved healthcare infrastructure is necessary to address the increasing complexity of chronic disease management in LMICs. Expanding the availability of skilled healthcare professionals remains fundamental for achieving resilient healthcare systems capable of delivering sustainable and patient-centered NCD care (Crisp and Chen, 2014).

STRATEGY	KEY ACTIONS	FOCUS AREA	EXPECTED IMPACT
 Digital Health and Telemedicine	• Teleconsultations and remote follow-up • Mobile health (mHealth) applications • Digital monitoring and decision support	 Technology-driven access and continuity of care	 Improved access, patient engagement and health outcomes
 Task-Shifting and Task-Sharing	• Delegating tasks to nurses, CHWs, pharmacists • Training and supportive supervision • Protocol-based care delivery	 Optimize limited health workforce	 Expanded service coverage and efficiency
 Multidisciplinary Care	• Collaboration among doctors, nurses, dietitians, pharmacists, and CHWs • Integrated care for multimorbidity	 Comprehensive and patient-centered care	 Better disease control, reduced complications and hospitalizations
 Health Policy and Universal Health Coverage (UHC)	• Strengthen primary health care • Financial protection and essential medicines access • Equity-focused policy implementation	 Equitable access and financial protection	 Reduced out-of-pocket costs and health inequities
 Strengthening Primary Health Care	• Risk factor screening and early detection • Chronic disease management services • Community outreach and health promotion	 Community-level prevention and management	 Early diagnosis and long-term disease control
 Health Policy Reforms	• Intersectoral policies on tobacco, alcohol, diet, and physical activity • Regulation and public health legislation	 Address social and behavioral risk factors	 Lower NCD risk factors and population-level health improvement
 Strengthening Internal Medicine Capacity	• Specialist training and continuous professional development • Research and local evidence generation • Mentorship and leadership development	 Building skilled and competent workforce	 High-quality care and resilient health systems
 Digital Integration in Health Systems	• Electronic health records • Health information systems • Data-driven decision making	 Data and information-driven health systems	 Improved planning, monitoring, and resource allocation

Fig4. Emerging strategies and future directions for strengthening NCD management in low- and middle-income countries
This figure shows new approaches for managing NCDs in low- and middle-income countries. It focuses on prevention, early detection, and better access to care. Digital health and community-based strategies are also included.

Source: Adapted from Anand *et al.* (2019); Haque *et al.* (2020); WHO (2025)

CONCLUSION

Non-communicable diseases have emerged as one of the most significant public health challenges facing low- and middle-income countries, contributing substantially to mortality, disability, healthcare costs, and socioeconomic instability. The increasing prevalence of cardiovascular diseases, diabetes, chronic respiratory diseases, cancers, and other chronic conditions continues to place enormous pressure on fragile healthcare systems that are already constrained by limited resources, workforce shortages, and persistent healthcare inequalities. The coexistence of infectious diseases and chronic illnesses further complicates healthcare delivery and underscores the

urgent need for integrated and sustainable approaches to disease management. Internal medicine has become increasingly central to addressing the growing burden of NCDs through early diagnosis, chronic disease management, preventive healthcare, multimorbidity management, and patient-centered care. Internists play a critical role in coordinating multidisciplinary healthcare services, improving continuity of care, and supporting evidence-based management of complex chronic conditions. Their contribution is particularly important in LMICs where healthcare systems require adaptable and comprehensive clinical approaches capable of addressing diverse and evolving health challenges.

Future progress in NCD prevention and control will depend on strengthening healthcare systems, expanding universal health coverage, improving access to essential medicines and diagnostic services, and investing in healthcare workforce development. Emerging strategies such as digital health, telemedicine, task-shifting, and integrated community-based interventions offer promising opportunities for improving healthcare accessibility and long-term disease management in resource-limited settings. Sustainable policy reforms, stronger primary healthcare systems, and increased investment in internal medicine capacity will therefore remain essential for reducing the burden of NCDs and improving population health outcomes across LMICs.

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Conflict of Interest

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